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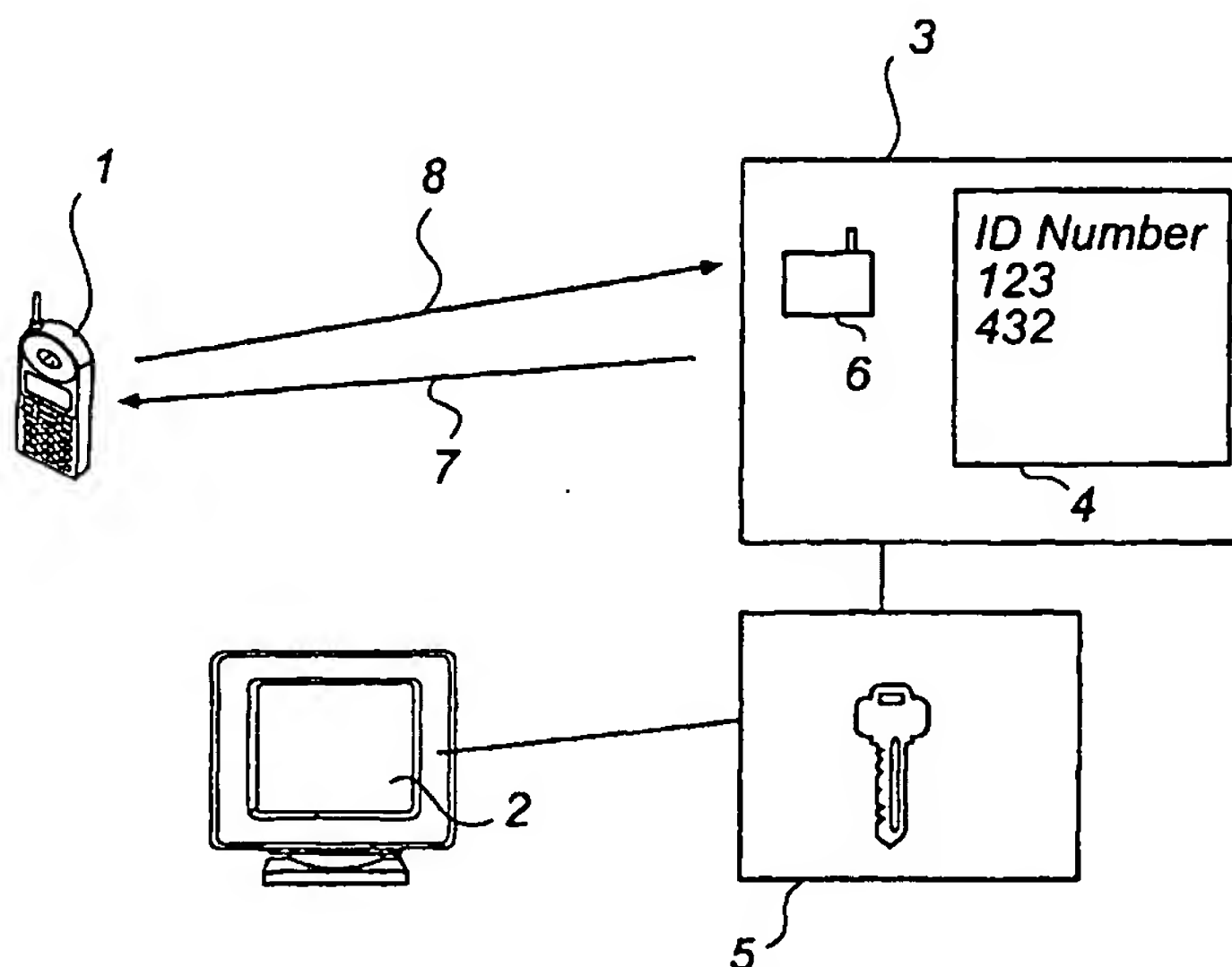
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(54) Title: AUTOMATIC LOCKING SYSTEM



(57) Abstract: A locking system according to the present invention comprises a control unit (3) with a memory (4), a mobile unit (1) with a specific identification number and an electronic locking unit (5). The control unit (3) being arranged to repeatedly transmit a first radio signal (7). The mobile unit (1) being arranged to transmit its identification number as a second radio signal (8) in response to receiving the first radio signal (7). The control unit (3) being further arranged to receive the second radio signal (8) and to disable the electronic locking unit (5) only if the identification number is in the memory (4).

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AUTOMATIC LOCKING SYSTEMField of the Invention

The present invention relates generally to a locking system comprising a control unit with a memory and an electronic locking unit.

5 Background of the Invention

In society there are numerous electronic locks on e.g. cars, doors, computers and other systems. These locks are operated either with a key unit or with a code. The key unit can be a plastic card or some key device. An  
10 access code is also a type of key and can be used together with a mobile key unit. Different kinds of locking systems require different kinds of keys. The users must carry many key devices and remember different access codes.

15 One type of locking system used in cars comprises a locking unit arranged in the car and a key unit carried by the driver of the car. The locking unit and the key unit communicate with IR. The locking unit controls for example the locking of the car doors. When the driver  
20 wants to lock or unlock the car he sends a signal to the locking unit by pressing a button on the key unit. A disadvantage is that the locking and unlocking of the system requires an active action by the user.

Summary of the Invention

25 It is an object of the present invention to provide a universal key unit, which is capable of locking and unlocking all kinds of locking system. This will make it possible to use the same key for all the locking systems to which the user has access.

30 This invention makes it possible to use the same electronic key for different locking units, for example, on cars, doors or computers.

According to a first aspect of the present invention, a locking system comprises a control unit with a

memory, a mobile unit with a specific identification number and an electronic locking unit, the control unit being arranged to repeatedly transmit a first radio signal, the mobile unit being arranged to transmit its identification number as a second radio signal in response to receiving the first radio signal, and the control unit being arranged to receive the second radio signal and to disable the electronic locking unit only if the identification number is in the memory.

One advantage of this aspect is that when a user, who has access to a locking system, approaches the control unit with a mobile unit, the control unit disables the electronic locking unit. Thus the device for which the locking system is arranged, is unlocked for the user. The inventive system saves time and is much easier to operate, for example because the user need not enter a code or handle a key. Another advantage is that the user must not remember different access codes. It is easy for a person with access to the identification numbers in the memory to add or remove identification numbers for a person's mobile unit. Thus, for example, the administrative measures in a company are reduced since there is no need to issue entry passes, distribute access codes or traditional keys, to the employees. The invention yields a smooth solution where there is no need for wires and extra personal equipment such as access cards.

Another advantage is that the users without any action can rely on the application, e.g. their computer to be secured when they are not present with their mobile unit in the vicinity of the control unit.

It is preferred that the control unit is arranged to keep the electronic locking unit disabled, if the second radio signal comprises an identification number that is available in the memory, and to enable the electronic locking unit in a different manner.

It is also preferred that the control unit is arranged to keep the electronic locking unit disabled

only when the second radio signal, comprising an identification number that is available in the memory, is received within a predetermined time limit from the transmission of the first signals and to enable the electronic locking unit in a different manner.

When a user is at a distance from a device for which the locking system is arranged, the control unit automatically locks the electronic locking unit. A user having access to the device can leave the device on which the locking system is arranged, with his mobile unit without any action, since the device will be locked automatically when the control unit no longer receives signals from the mobile unit. Since there is no risk of forgetting to lock the unit, the security is also increased.

Preferably the first and the second radio signal is performed by Bluetooth as defined by the Bluetooth Special Interest Group (SIG).

The advantages of using Bluetooth are that Bluetooth can be integrated at a low cost and that communication with Bluetooth is very safe. Bluetooth is a standard for wireless communication of data and voice developed by, among others, Ericsson, Nokia, Intel, IBM and Toshiba in a joint venture project. Bluetooth gives a maximal speed and a maximal range. Today the Bluetooth standard gives a 2 Mbit connection within a 10 m area, but this can change. The Bluetooth chipset is very cheap. Using Bluetooth in the phone and, for example, the PC will give a unique solution where the features described above will be possible within the Bluetooth range from the PC without any action whatsoever by the user. If the user has no phone, a cheap digital key may be provided. Another advantage of using Bluetooth is that every Bluetooth chip has a unique address. This address can be used as the identification number.

Preferably the mobile unit is a mobile phone. The advantage of using a mobile phone is that mobile phones have an inherent identification number. Another

advantage is that the next generation mobile phones will be equipped with Bluetooth and therefore there is no need for a user to carry additional mobile units for different kinds of locking systems. Accordingly, the mobile phone  
5 can be used as an electronic key device, which can open all electronic locking units to which the user has access, i.e. having its identification number of the mobile unit in the memory or the Bluetooth chip identification number.

10 In one embodiment of the present invention, the control unit controls the logon and logoff process on a computer.

One advantage of this is that when the user arrives at the office in the morning, the PC will automatically  
15 boot with the profile of the user, thus saving several minutes each day as well as the trouble of remembering and keying in the personal identification and password. Another advantage is that time is saved as the user does not have to wait for the PC to heat up when he has been  
20 away for a while and the computer changes to power saving mode.

In another embodiment of the present invention, the electronic lock controls a door lock. The control unit sends the requests and when a person with a mobile unit  
25 approaches the door, his mobile unit replies to the request. The control unit checks if the ID of the mobile unit has access to enter the door. If it has access, the control unit unlocks the door and the person can enter the room. The control unit can further be arranged to  
30 check how many people are in the room by counting how many people have entered or left the room. For example, when a room is empty the control unit can send a signal comprising a request to turn off the light, or a signal that activates an alarm system. The control unit can also  
35 keep track of which people are in which rooms. This is possible because each ID number in a mobile unit can be

connected to a specific person. The door lock is then working as a passage system.

According to a second aspect of the present invention, a control unit for controlling an electronic locking unit comprising a memory is arranged to repeatedly  
5 transmit a first radio signal and to receive a second radio signal comprising an identification number and to disable the electronic locking unit only if the identification number is in the memory.

10 According to a third aspect of the present invention, a method is provided for locking and unlocking an electronic locking unit controlled by a control unit, which is arranged to communicate with a mobile unit. The method comprises the steps of storing at least one identification number, sending a request from the control  
15 unit by a first radio signal, receiving in the control unit a second radio signal comprising an identification number, comparing the identification number with the at least one identification number stored, and disabling the  
20 electronic locking unit if the identification number matches one of said at least one identification number stored in the memory.

The request requests an identification number of a mobile unit. When the mobile unit receives a request, it  
25 sends its identification number. The control unit receives this number and checks its access to the electronic locking unit.

Preferably the method also comprises the step of accepting the request in the mobile unit by an activity  
30 made by a carrier of the mobile unit. The carrier of the mobile unit can make the acceptance, for example, by entering a PIN (Personal Identification Number) code or just by pressing a key on the mobile unit. The advantage of this is that an electronic locking unit is not un-  
35 locked by mistake. With the PIN code the security is also increased because if, for example, the mobile unit is

stolen, the user also needs the PIN code to unlock the electronic locking unit.

In a preferred embodiment of the present invention, the step of accepting comprises pressing a button on the mobile unit. In this way the user can accept or not  
5 accept the request of the first signal. This can work as an additional safety action. For example, the user can enter a code.

According to a fourth aspect of the present invention, a computer program product directly loadable into  
10 the internal memory of a digital computer comprises software code instructions for performing the steps of the above-mentioned method when said product is run on a computer.

#### 15 Brief Description of the Drawings

Fig. 1 shows a block diagram of the automatic locking system according to a preferred embodiment of the present invention.

Fig. 2a is a flow chart of a method according to a  
20 preferred embodiment of the present invention.

Fig. 2b is a flow chart of a method according to a preferred embodiment of the present invention.

Fig. 3 shows a block diagram of the automatic locking system according to an alternative embodiment of  
25 the present invention.

Fig. 4 is a flow chart of a method according to an alternative embodiment of the present invention.

#### Detailed Description of Preferred Embodiments

The invention will now be described with reference  
30 to Fig. 1, which schematically shows an automatic locking system, and to Fig. 2a and 2b, which is a flow chart of locking and unlocking of an electronic locking unit. The automatic locking system comprises a control unit 3 and an electronic locking unit 5, which are integrated in a  
35 computer 2. An electronic key is integrated in a mobile phone 1 and thus there is no need for a special key device. Thus, it is possible for a user, if he already

has a mobile phone equipped with Bluetooth, to use this mobile phone as a key. The only thing the user needs in order to open different kinds of locks is a mobile phone 1 with its unique identification code (ID number), which becomes the electronic key. The mobile phone 1 has a unique ID number and can receive and send radio signals with Bluetooth at 2.45 GHz. The control unit 3 comprises a memory 4 containing a list of ID numbers representing people which are allowed to have access to the computer 2. This list is easily changed which is an advantage when the user wants to allow or deny access to the computer 2 for different people. The control unit 3 also comprises a transceiver 6 that can send a first radio signal 7 and receive a second radio signal 8 using Bluetooth. The electronic locking unit 5 can logon or logoff the computer 2. When the computer 2 is logged off, the control unit 3 repeatedly sends a first radio signal 7 from the transceiver 6. When a mobile phone 1 receives the first radio signal 7 at its transceiver 6, it sends to the control unit 3 a second radio signal 8 comprising the ID number of the mobile phone 1. The control unit 3 receives the ID number and compares it with the ID number of the list to check if there is a match. If there is no match it ignores the second radio signal 8. If there is a match, the control unit 3 sends a control signal to the mobile phone 1 to make sure the user really wants to logon the computer 2. The user presses a button of the mobile phone 1 to accept the logon. The mobile phone 1 sends a signal to the control unit 3 and the control unit 3 disables the electronic locking unit 5, which means that the carrier of the mobile phone 1 logs on the computer 2.

When the computer 2 is logged on, the control unit 3 frequently checks for a match between the ID number of the second radio signals 8 and the ID number of the mobile phone 1 that logged on the computer 2. When there is no longer a response from this mobile phone 1 to the

first radio signal 7, the electronic locking unit 5 locks the computer and the carrier of the mobile phone 1 is logged off. The control unit 3 is arranged to send a request 200 to check if there is a reply 210 to the request. The request asks for the ID number of a mobile phone. A reply comprises the ID number of the mobile phone that is positioned in the vicinity of the control unit 3. If there is no reply, the control unit 3 logs off 220 the user from the computer. If there is a reply, the control unit 3 compares 230 the received ID number with only the ID number that made the control unit unlock the computer, i.e. ignores the rest of the list of the ID numbers, to check if there is a match 240. If there is no match and no more replies from other mobile phones have been received, it logs the computer off 250. If there are more replies, it checks them for a match in the same way as above. If there is a match it sends a new request 200.

Preferably the computer can also be manually logged on or off. This is useful, e.g. when the battery of the mobile phone is run down.

The communication between the mobile unit and the control unit is not limited to the use of Bluetooth, but can use any other means for communication, e.g. IR. The mobile unit can be, for example, a card that the user may have in his wallet. The system of the invention can be arranged later on different kinds of equipment, which means that the invention can be used on existing equipment.

According to the invention, the electronic locking unit 5 is not limited to logoff the computer 2 when there is no longer a response from the mobile phone 1, but it can also just lock the computer for unauthorised people, if for example the user leaves the room for a while.

According to an alternative embodiment of the present invention, the control unit controls a Personal Digital Assistant (PDA) and the mobile unit is a mobile phone. This control unit can be arranged to lock the PDA

when the mobile phone no longer answers the request. It can also be oppositely arranged, i.e. the control unit is arranged to lock the mobile phone when the PDA no longer replies to the requests. This increases security in case  
5 a portable unit is stolen.

In another embodiment the control unit controls a door lock. The function is about the same as in the first embodiment, but the computer is exchanged for a door. This embodiment will now be explained with reference to  
10 Fig. 3, which schematically shows an automatic locking system, and to Fig. 4, which is a flow chart of locking and unlocking of an electronic locking unit.

The automatic locking system comprises a control unit 12 and an electronic locking unit 14, which are  
15 integrated with a door 11. An electronic key is integrated in a mobile phone 10 and thus there is no need for special key device. The mobile phone 10 has a unique ID number and can receive and send radio signals using Bluetooth. The control unit 12 comprises a memory 13  
20 containing a list of ID numbers representing people that are allowed to open the door 11. The control unit 12 also comprises a transceiver 15 that can send a first radio signal 16 and receive a second radio signal 17 using Bluetooth. The electronic locking unit 14 can unlock or  
25 lock a door 11.

The control unit 12 repeatedly sends 300 a first radio signal 16 from the transceiver 15. A person with a mobile phone 10 comes into the vicinity of the electronic locking unit and the door he wishes to pass through. The  
30 mobile phone 10 receives 310 the first radio signal 16 in its transceiver and sends 320 to the control unit 12 a second radio signal 17 comprising the ID number of the mobile phone 10 as a response to the first radio signal 16. The control unit 12 receives 330 the ID number and  
35 compares 340 it with the ID number of the list to check if there is a match 350. If there is no match it ignores the second radio signal 17 and the door 11 remains lock-

ed. If there is a match, the control unit 12 sends 360 a control signal to the mobile phone 10 to make sure the carrier of the mobile phone is the person with access to the electronic locking unit 14. The carrier enters 370 a  
5 PIN code on the mobile phone 10 to accept the unlocking of the door 11. The mobile phone 10 sends a signal to the control unit 12 and the control unit 12 disables 380 the electronic locking unit 14, which means that the door unlocks and the carrier of the mobile phone 10 can open  
10 the door 11. When the door 11 is closed it is locked again.

Although different embodiments of the invention have been described for the purpose of illustration, it will be understood that various changes, modifications and  
15 substitutions may be incorporated in the embodiment without departing from the spirit and scope of the invention.

For example, when the computer is logged on, the control unit can be arranged to send the request less frequently.

## CLAIMS

1. A locking system comprising a control unit (3) with a memory (4) and an electronic locking unit (5),  
5 c h a r a c t e r i z e d in that it comprises a mobile unit (1) with a specific identification number, the control unit (3) being arranged to repeatedly transmit a first radio signal (7), the mobile unit (1) being arranged to transmit its identification number as a second  
10 radio signal (8) in response to receiving the first radio signal (7), and the control unit (3) being arranged to receive the second radio signal (8) and to disable the electronic locking unit (5) only if the identification number is in the memory (4).
- 15 2. The locking system as defined by claim 1, wherein the control unit (3) is arranged to keep the electronic locking unit (5) disabled, if the second radio signal (8) comprises an identification number that is in the memory (4) and to enable the electronic locking unit (5) in a  
20 different manner.
3. The locking system as defined in claim 1, wherein the control unit (3) is arranged to keep the electronic locking unit (5) disabled only when the second radio signal (8), comprising an identification number that is  
25 in the memory (4), is received within a predetermined time limit from the transmission of the first signal (7) and to enable the electronic locking unit (5) in a different manner.
4. The locking system as defined in any one of the  
30 preceding claims, wherein the first and the second radio signal (7,8) comply with Bluetooth.
5. The locking system as defined in any one of the preceding claims, wherein the mobile unit (1) is a mobile phone.
- 35 6. The locking system as defined in any one of the preceding claims, wherein the control unit (3) controls the logon and logoff process on a computer (2).

7. The locking system as defined in any one of claims 1 through 5, wherein the control unit (3) controls the locking and unlocking on a door lock.

8. A control unit (3) for controlling an electronic locking unit (5) comprising a memory (4), c h a r a c -  
5 t e r i z e d in that the control unit (3) is arranged to repeatedly transmit a first radio signal (7) and to receive a second radio signal (8) comprising an identification number and to disable the electronic locking  
10 unit (5) only if the identification number is in the memory (4).

9. The control unit (3) as defined in claim 8, wherein the control unit (3) is arranged to keep the electronic locking unit (5) disabled only when the second  
15 radio signal (8), comprising an identification number that is in the memory, is received within a predetermined time limit from the transmission of the first signal (7) and to enable the electronic locking unit (5) in a different manner.

20 10. A method of locking and unlocking an electronic locking unit (5) controlled by a control unit, which is arranged to communicate with a mobile unit, comprising the steps of:

storing at least one identification number,  
25 sending (100) a request from the control unit (3) by a first radio signal (7),  
receiving (110) in the control unit a second radio signal (8) comprising an identification number,  
comparing (140) the identification number with the  
30 at least one identification number stored, and  
disabling (180) the electronic locking unit (5) if the identification number matches one of said least one identification number.

11. The method as defined in claim 10, further  
35 comprising the step of:

accepting (170) the request in the mobile unit (1) by an activity made by a carrier of the mobile unit.

12. The method defined in any one of claims 10 through 11, wherein the step of accepting comprises: pressing (170) a button on the mobile unit (1).

13. A computer program product directly loadable  
5 into the internal memory of a digital computer, comprising software code instructions for performing the steps of:

storing at least one identification number,  
sending (100) a request from the control unit (3) by  
10 a first radio signal (7),  
receiving (110) in the control unit a second radio signal (8) comprising an identification number,  
comparing (140) the identification number with the stored at least one identification number, and  
15 disabling (180) the electronic locking unit (5) if the identification number matches one of said least one identification number, when said product is run on a computer.

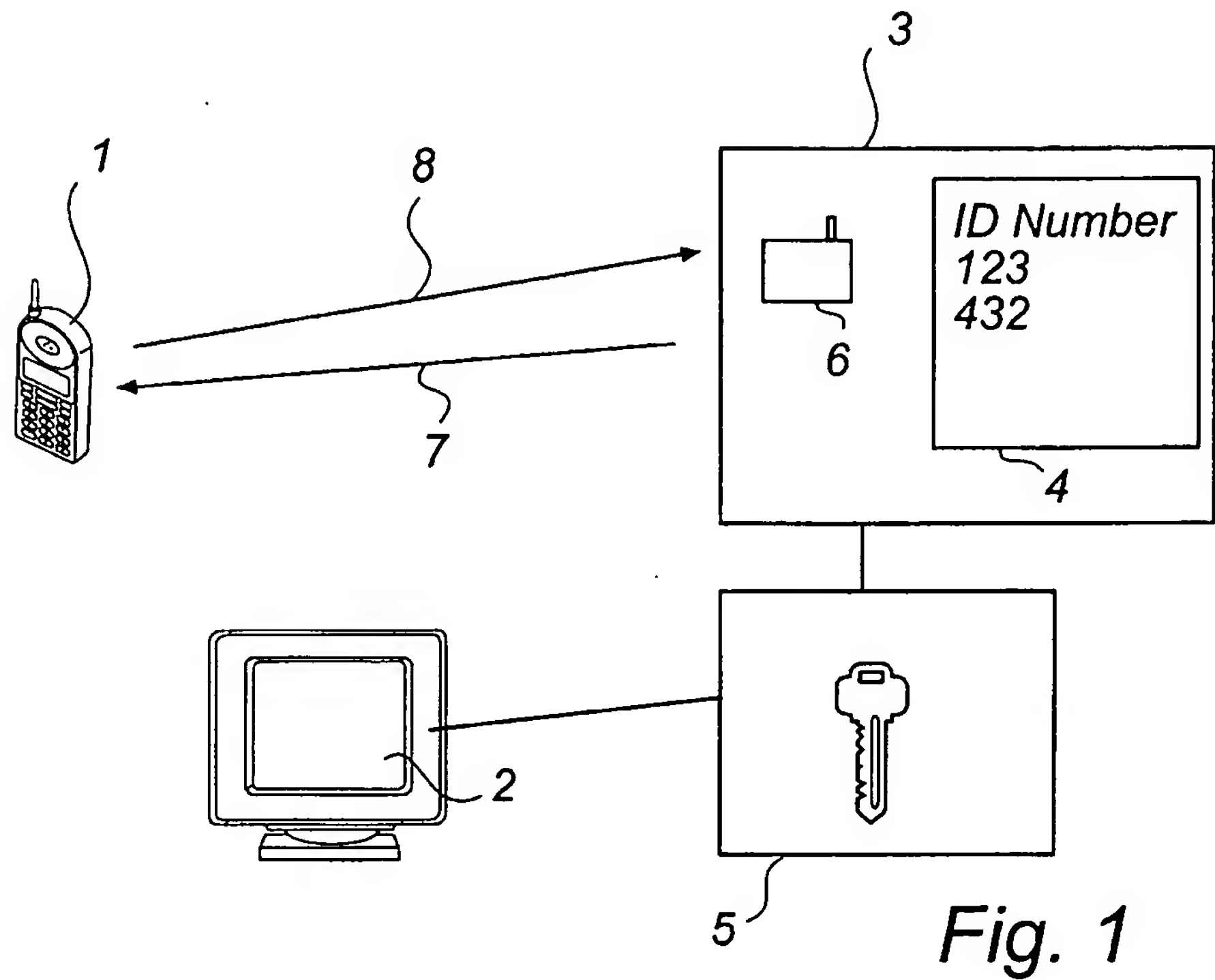


Fig. 1

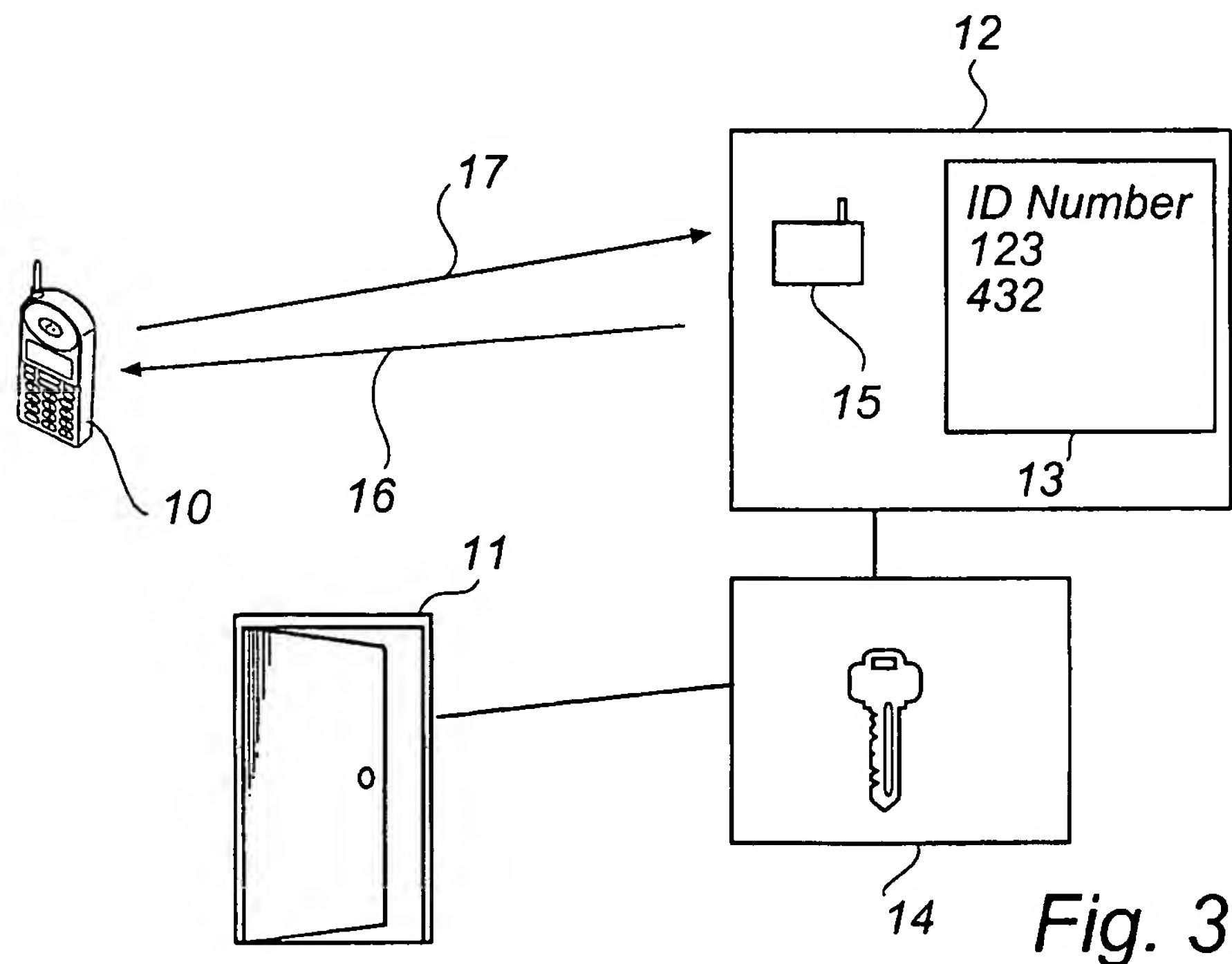
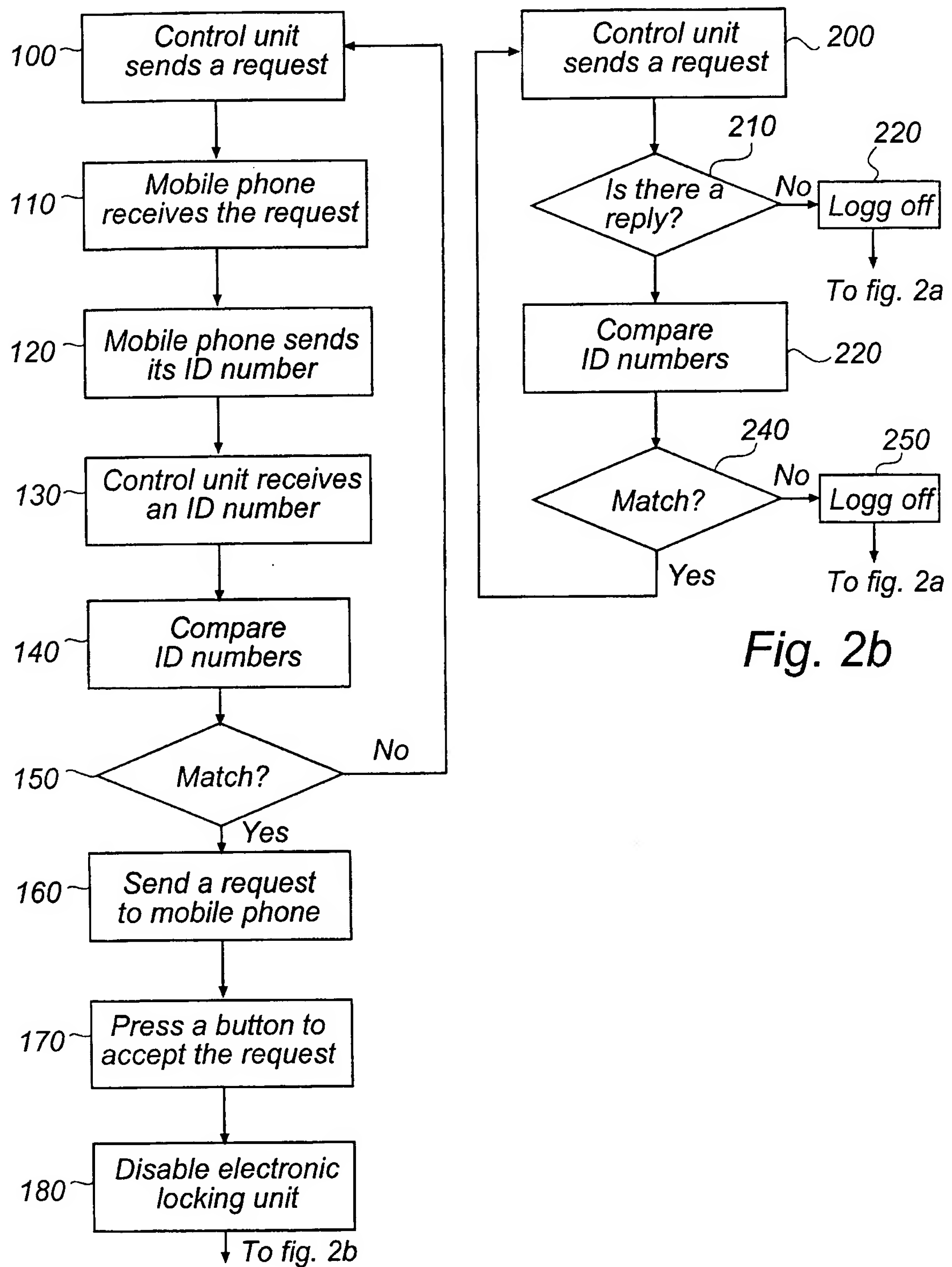


Fig. 3

2/3

*Fig. 2b**Fig. 2a*

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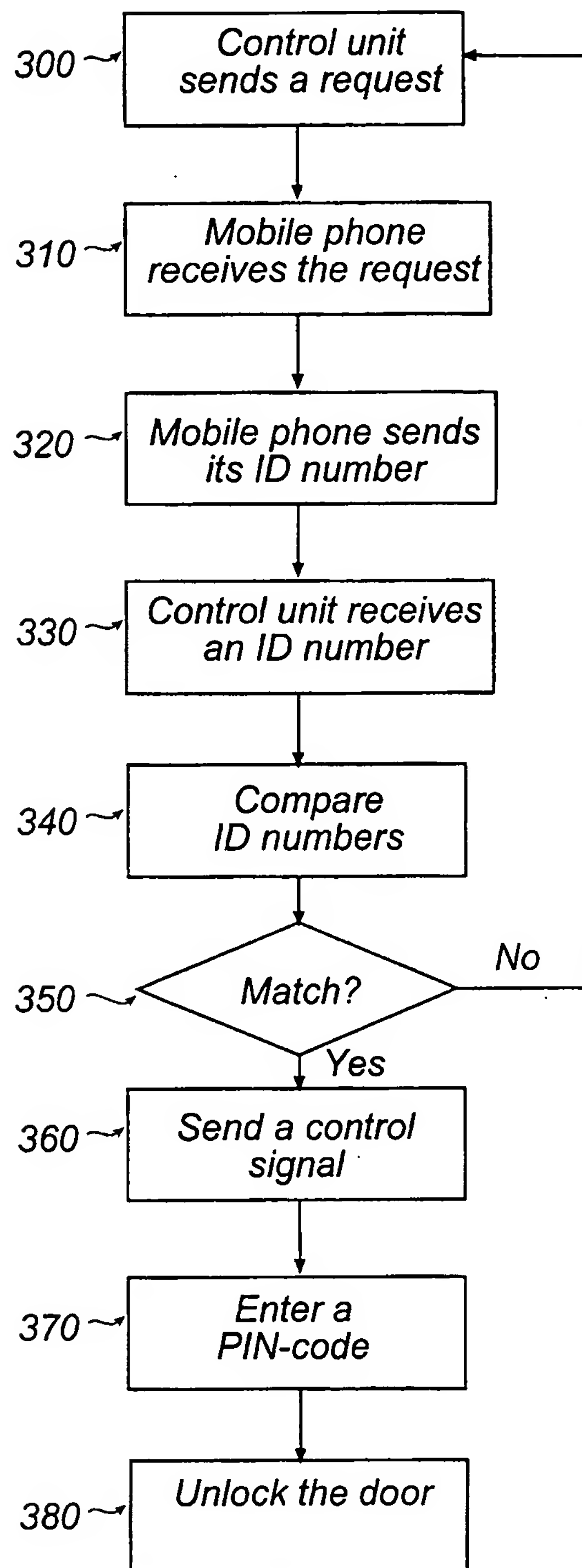


Fig. 4

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 00/01869

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: E05B 49/00, G01F 1/00, H04L 9/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: E05B, G01F, H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

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Y	Ericsson review, Volume 3, 1998, JAAP HAARTSEN, "Bluetooth-The universal radio interface for ad hoc, wireless connectivity" page 110 - page 117	4-5
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☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

\* Special categories of cited documents:

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Date of the actual completion of the international search

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 00/01869

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